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SEDIMENTATION SURVEY OF LAKE LOAMI, SANGAMON COUNTY, ILLINOIS

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INTRODUCTION

In June 1987 the Illinois State Water Survey conducted a sedimentation survey of Lake Loami, the water supply reservoir of the village of Loami, Illinois. Village employees assisted Water Survey personnel in the survey. The results are presented in this report.

Acknowledgments

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The study was conducted under the administrative guidance of Richard G. Semonin, Water Survey Chief; Michael L. Terstriep, Surface Water Section Head; and Nani G. Bhowmik, Surface Water Section Assistant Head. Edward Delisio and Laura Keefer of the Water Survey and Jeff Shefler of Loami assisted with field data collection; Becky Howard prepared the camera-ready copy; John Brother prepared the figures; and Gail Taylor edited the report.

Reservoir Location

The reservoir is located in the northeast corner of Section 15, T.14N., R.7W., at approximately 39°40'00" north latitude, 89°51'15" west longitude. The reservoir is approximately 0.5 mile southwest of the village. Figure 1 shows the locations of the village, reservoir, and watershed.

Reservoir History

The reservoir was originally constructed in 1957 as a levied storage basin. This original lake, referred to in this report as the east basin, was 4.5 acres in size and had a capacity of 9.5 million gallons. This reservoir was used as a side-channel reservoir to store water pumped from Lick Creek, approximately 0.25 mile to the south.

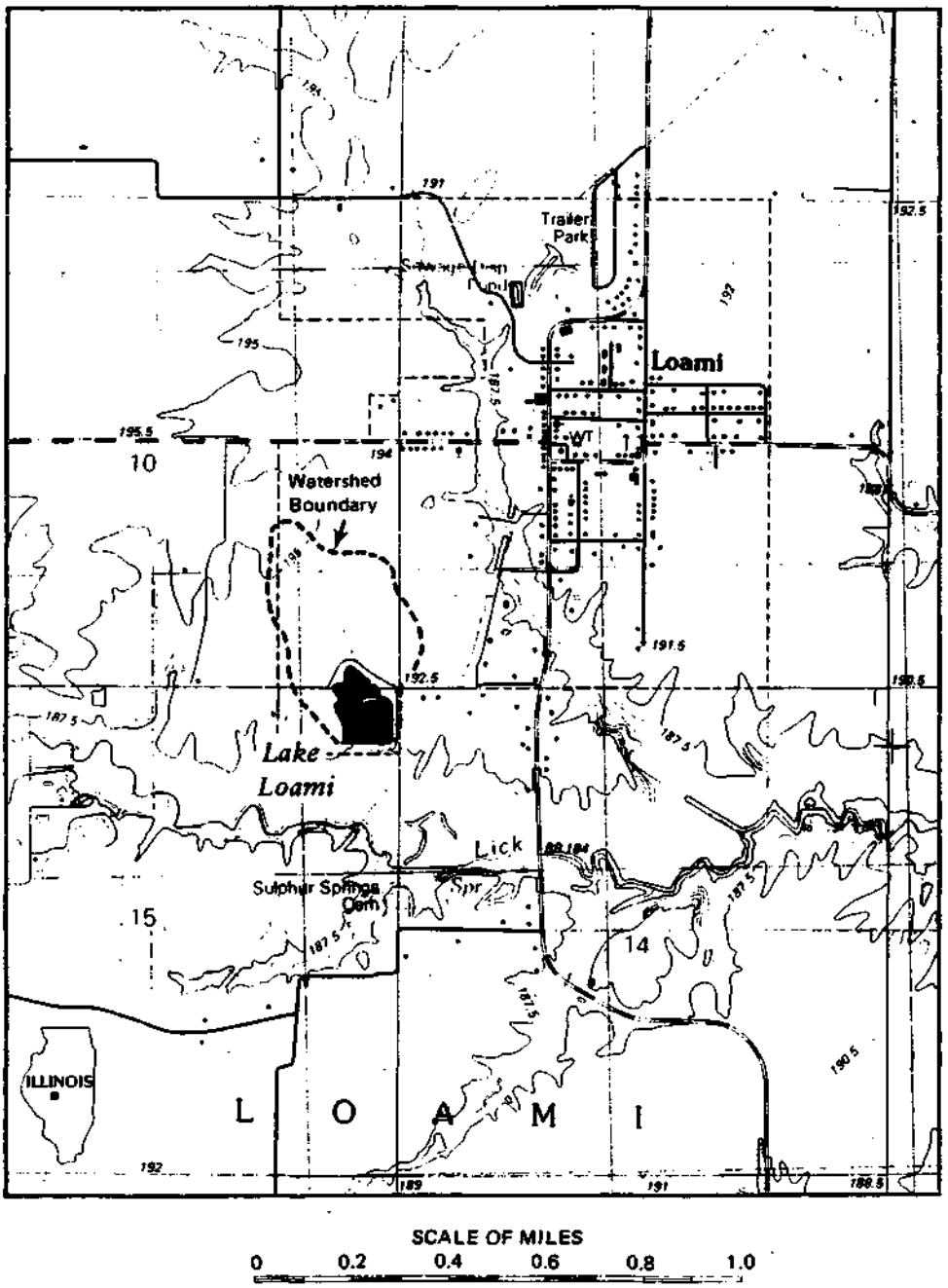

Figure 1. Location and watershed boundary of Lake Loami

In 1976, the levee surrounding the lake was damaged by muskrats. In 1978, as an alternative to rebuilding the damaged levee, a new impounding dam was constructed which closed in a small creek running adjacent to the reservoir. The new larger reservoir that was created was at a slightly higher spillway elevation than the former reservoir and was about 2.5 times as large in both area and volume. The 1987 surface area of the reservoir is 10.1 acres, and the capacity at spillway level is 71.1 acre-feet (23.2 million gallons). The water level in the reservoir is still supplemented by pumpage from Lick Creek.

Watershed

From 1957 to 1978, the natural drainage to Lake Loami was limited to direct precipitation and the limited drainage from the levee banks. The watershed of the reservoir was extended by pumping to include all of Lick Creek above the location of the pump intake. Assuming that the operation of the pump was properly timed, very limited sediment inputs would have reached the lake.

When the dam was constructed across the creek valley in 1978, the drainage of the creek increased the natural inflow of both water and sediments to the lake. The total natural drainage area (figure 1) of the expanded lake is 53 acres, including both land and water surface areas.

SEDIMENTATION SURVEY

Before the lake sedimentation survey was conducted, a rectangular grid was laid out to facilitate both the sedimentation survey and a survey of the lake area. Four principal survey points were located, surveyed, and monumented. These points were identified according to their geographic locations as NE (northeast), NW, SW, and SE. The resulting grid is 763.4 feet wide in the east-west direction and 609.4 feet wide in the north-south direction.

These four principal points were used to map the lake by angle and distance measurements and were then used to lay out cross section lines for the sedimentation survey. The resulting grid and cross section survey plan are shown in figure 2.

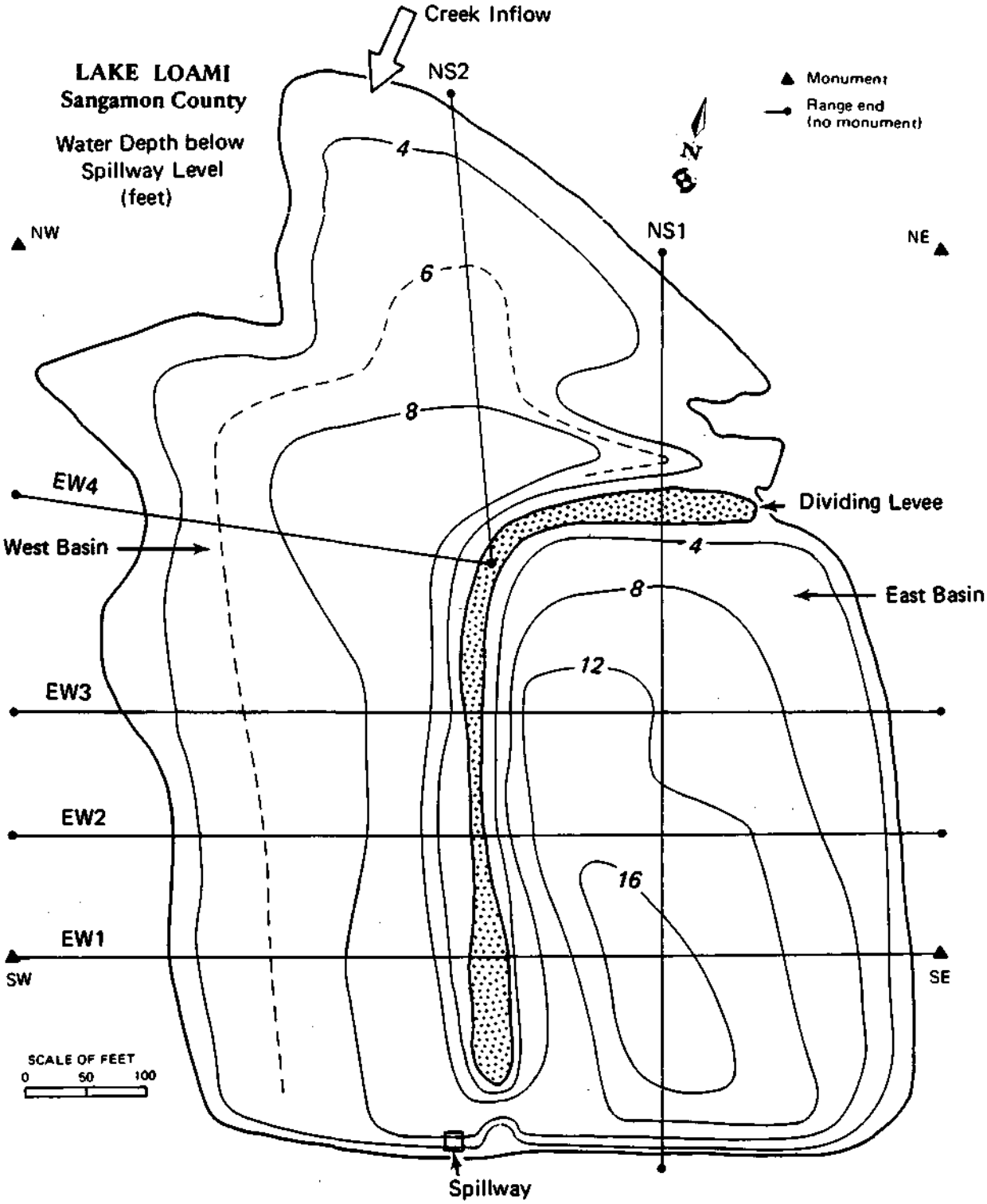

Figure 2. Lake Loami survey plan and depth contours

Standardized procedures were used for the cross section profiling. Horizontal control was maintained by using a marked cable; the water surface was used for vertical control; and a sounding pole was used to measure the 1987 water depth and sediment thickness.

Water Volumes

All water volumes were calculated by using the contour area-depth calculation. The water depths measured in the field survey were plotted on a map of the lake, and 4-foot contours (plus a supplemental 6-foot contour in the west basin) were drawn as shown in figure 2. The east and west basins were then analyzed separately to determine the area of each depth contour. The volumes of the basins were calculated by using the following formula for each contour interval:

$$V = \Delta D\ (A_u + A_L + \sqrt{A_u\ A_L})/3$$

where

V = contour interval volume

ΔD = distance between contours

A_u = area of the upper contour

A_L = area of the lower contour

The volumes of all the contour intervals were then summed to determine the basin volumes. The 1987 volumes for the reservoir based on the spillway level as a reference water level are given in table 1.

The stage-volume-area relationships for Lake Loami and its two subbasins are presented in table 2. A 2-foot drawdown depth increment was used. The original calculations of area and volume were based on the 4-foot contour intervals shown in figure 2 (with a supplemental 6-foot

Table 1. Lake Loami Basin Volumes, 1987

	Acre-feet	Million gallons
East basin	37.6	12.3
West basin	33.5	10.9
Total lake	71.1	23.2

Table 2. 1987 Stage-Volume-Area Relationships for Lake Loami

Drawdown	Total		East basin		West basin	
(feet)	(area)	(volume)	(area)	(volume)	(area)	(volume)
0	10.1	71.1	3.93	37.6	6.15	33.5
2	9.0	53.1	3.69	30.2	5.31	22.9
4	7.9	35.1	3.47	22.8	4.47	12.3
6	5.9	23.3	2.97	16.7	2.76	5.1
8	3.8	12.1	2.53	10.9	1.26	1.2
10	2.6	7.7	1.91	7.1		
12	1.3	3.3	1.34	3.3		
14	0.8	1.7	0.79	1.7		
16	0.3	0.2	0.31	0.2		

Note: For drawdown = 0, 4, 8, 12, and 16 feet (and for drawdown — 6 feet in the west basin) all values were taken from the original calculations. Intermediate values were interpolated.

contour interval in the west basin). The intermediate values were calculated by using a straight-line interpolation.

Sedimentation Patterns

Field measurements of sediment thickness were plotted on a map of the lake, and lines of equal sediment thickness were drawn as shown in figure 3. The distribution of sediment in Lake Loami is closely related to the original lake depth and basin configurations. More sediment has accumulated in the deeper western edge of the east basin and in the old creek channel along the east edge of the west basin than in the rest of the reservoir. Less sediment has accumulated in the newer west basin than in the east basin.

Sedimentation rates apparently are no higher in the north end of the west basin than in the south end. The north end would be expected to have a slightly higher sedimentation rate because of the proximity of the natural drainage inflow. A small sedimentation basin on the north side of the road may be decreasing the sedimentation rate in this area.

Sediment volumes were calculated by averaging the measured sediment thicknesses within bounding contours and multiplying them by the area between contours.

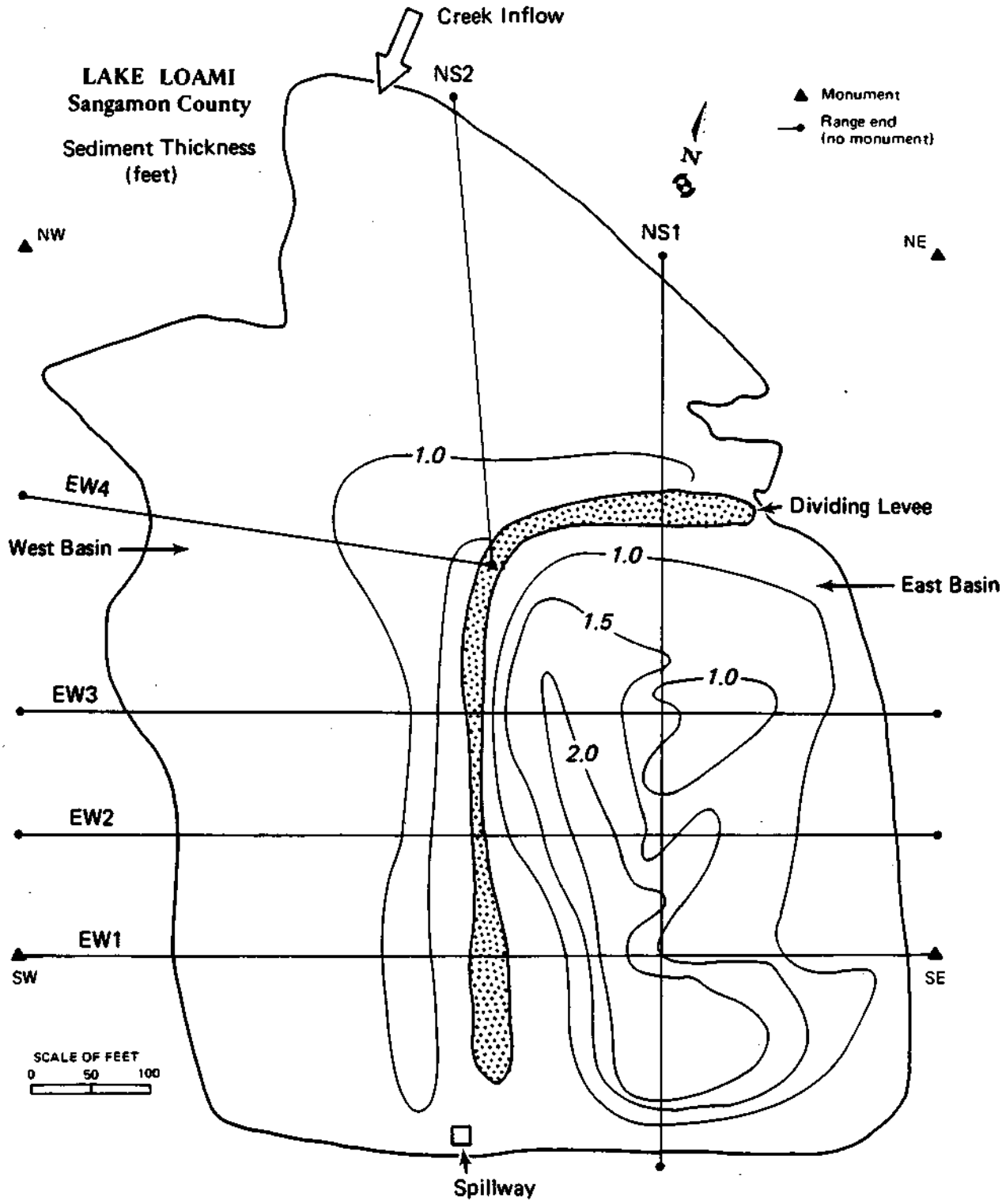

Figure 3. Sediment distribution in Lake Loami

Sedimentation Rates

The analysis of sedimentation rates for Lake Loami (see table 3) is based on a separation of the east and west basins because of differences in age and inflow characteristics. The east basin has existed for 30 years. The inflow to this basin is presumed to have been controlled to reduce sediment inflows during pumping. During the last nine years, this basin has been subject to minimal sediment inputs from the natural drainage of the west basin.

The west basin has existed for only nine years and has been directly impacted by its natural inflow and associated sedimentation. Because the pumped inflow structure is in the east basin, it is assumed that the west basin has been only slightly impacted by the sediment from Lick Creek. Thus, for this rate analysis, it is presumed that the source of all east-basin sediments is the pumping from Lick Creek, and that the west basin sediments all originate in natural drainage.

The annual sedimentation rate of the east basin (0.16 acre-feet) is only about one-third the sedimentation rate in the west basin (0.47 acre-feet) . This is due to the higher degree of control of inflows to the east basin. Combining the annual rates of sedimentation in the two basins, Lake Loami is losing 0.63 acre-feet (0.21 million gallons) of storage per year.

Table 3. Sediment Accumulation in Lake Loami

Basin	Age (years)	Total accumulated sediment (acre-feet)	Annual sedimentation rates (acre-feet)	(% of original capacity)	(tons)	(tons/acre of watershed)
East	30	4.93	0.16	0.39	104	
West	9	4.27	0.47	1.25	307	3.8
Total		9.20	0.63	0.78		

* Based on an estimated unit weight of 30 pounds per cubic foot

SUMMARY

The Illinois State Water Survey has conducted a sedimentation survey of Lake Loami, the water supply reservoir for the village of Loami in Sangamon County, Illinois. The results indicate that the 1987 lake capacity is 23.2 million gallons. This capacity is being lost to the process of sedimentation at a rate of 0.21 million gallons per year.

Sedimentation rates are higher in the west basin of the lake because of the inflow of sediments from natural drainage. The east basin is primarily subject to sediments from the pumped inflow of Lick Creek water. This pumped inflow can be timed to reduce sediment inputs to the lake.